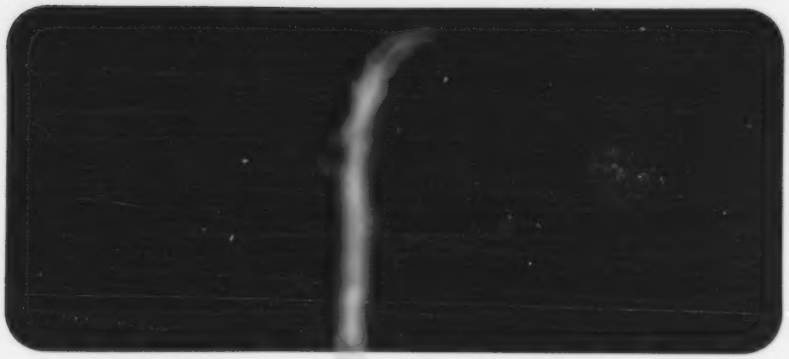
Environment Canada | Environnement Canada

Conservation and Protection | Conservation et protection

Environmental Protection | Protection de l'environnement



Environment Canada Environnement

Regional program report (Canada. Environmenta
l Protection Service. Pacific Region)
Vol: 89 No: 3 Date: 891000

TD 171.5.C3 R43 2022993I
OOFF EXC 1

ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
ENVIRONMENTAL PROTECTION
PACIFIC AND YUKON REGION

1989 ANNUAL REPORT

LEADED AND LEAD-FREE GASOLINE REGULATIONS MONITORING PROGRAM

Regional Program Report - 89-03

By

Mark Cividin
David Poon

OCTOBER 1989

91-00662/

ABSTRACT

This report describes the gasoline monitoring program conducted in British Columbia during 1989. Samples of leaded and lead-free gasoline were collected and analyzed to check the lead content and verify compliance with the Leaded and Lead-Free Gasoline Regulations.

Surveys were also conducted to investigate the practice of nozzle switching on leaded gasoline dispensing pumps at retail outlets and the practice of motorists misfueling vehicles that are designed to use lead-free gasoline.

This is the first time in 15 years that we have found full compliance with the Lead-Free Gasoline Regulations. None of the 303 samples contained lead in excess of the allowable 0.013 grams per litre.

RESUME

Ce rapport décrit les programmes d'échantillonnage l'essence menés en Colombia Britannique en 1989. Des échantillon d'essence avec et sans plomb ont été recueillis et analysés pour vérifier le contenu en plomb et en vérifier la conformité avec les règlements sur l'essence sans plomb.

D'autres études furent aussi conduites. L'une visait à déterminer l'ampleur des pratiques de changement du bec vereur de pompes distribuant de l'essence avec plomb tandis que l'autre examinait les pratiques des automobilistes remplissant leurs véhicules conçus pour de l'essence sans plomb avec une essence non designée.

C'est la première fois en 15 ans que nous avons trouvé un taux de conformité complet avec les règlements sur l'essence sans plomb. Aucun des 303 échantillons contenait du plomb taux alloué de 0.013 grammes par litre.

TABLE OF CONTENTS

		PAGE
ABSTRACT		i
RESUME		ii
TABLE OF CONTENTS		iii
	List of Figures	iv
	List of Tables	v
SUMMARY		vi
1	INTRODUCTION	1
2	LEADED GASOLINE AND LEAD-FREE GASOLINE MONITORING	4
3	NOZZLE SWITCHING SURVEY	5
4	MISFUELING SURVEY	7
5	RESULTS	8
	5.1 Leaded Gasoline Monitoring	8
	5.2 Lead-Free Gasoline Monitoring	9
	5.3 Nozzle Survey	9
	5.4 Misfueling Survey	10
6	DISCUSSION	12
APPENDIX I	DATA RECORDING FORMAT FOR MISFUELING SURVEY	25
APPENDIX II	HISTORICAL DATA ON LEAD-FREE GASOLINE CONTAMINATION	28

LIST OF FIGURES

FIGURE		PAGE
1	PLASTIC TEMPLATE FOR NOZZLE SIZE MEASUREMENT	5
2	LEAD IN GASOLINE - HISTORICAL TREND FOR BRITISH COLUMBIA	14
3	AMBIENT LEAD CONCENTRATION IN BRITISH COLUMBIA	15

LIST OF TABLES

TABLE		PAGE
1	SURVEY RESULTS FOR LEAD-FREE GASOLINE MONITORING AND NOZZLE SWITCHING	vii
2	NOZZLE SIZE OF GASOLINE DISPENSING PUMPS	6
3	LEADED GASOLINE MONITORING - AREAS SAMPLED	8
4	LEADED GASOLINE MONITORING - NON-COMPLIANCES	8
5	LEAD-FREE GASOLINE MONITORING - BRITISH COLUMBIA ..	16
6	LEAD-FREE GASOLINE MONITORING - AREAS SAMPLED	17
7	NOZZLE SURVEY - BRITISH COLUMBIA	19
8	NOZZLE SURVEY - LOWER MAINLAND	20
9	NOZZLE SURVEY - OKANAGAN	21
10	NOZZLE SURVEY - VANCOUVER ISLAND	22
11	NOZZLE SURVEY - LOWER MAINLAND (BY AREA)	23
12	NOZZLE SURVEY - OKANAGAN (BY AREA)	23
13	NOZZLE SURVEY - VANCOUVER ISLAND (BY AREA)	24

SUMMARY

The Pacific and Yukon Regional office of Environmental Protection, Environment Canada monitors the lead levels in leaded and lead-free grades of gasoline in British Columbia with the federal Leaded Gasoline and Lead-Free Gasoline Regulations. The 1989 monitoring results indicate that the petroleum refineries were in compliance with the Regulations; and that there is a continuing trend towards improved compliance with respect to the rates of lead-free gasoline contamination in the gasoline marketing system. In 1989, 303 samples of lead-free gasoline were collected from retail outlets. None of these samples contained lead in excess of the allowable lead content of 0.013 grams per litre and hence full compliance has been achieved. This indicates a continuous improvement from 2.6% in 1985, 1.4% in 1986, 0.8% in 1987, and 0.6% in 1988.

Nozzles of leaded gasoline pumps were also checked; and 7 out of 502 nozzles were undersized. The nozzle switching rate was therefore 1.4%, which is well below the rates of 9%, 6%, 3.2% and 4.4% of 1985, 1986, 1987 and 1988 respectively.

In a survey of misfueling practices at 7 Vancouver area retail outlets, a total of 250 vehicle refuelings were observed. None of the 172 motorists refueled leaded gas to their lead-free burning cars. While 11 of the remaining 78 motorists refueled lead-free gas into their vehicles that were designed to run on leaded gasoline.

A summary of the lead-free gasoline monitoring result and nozzle switching surveys is presented in Table 1.

SUMMARY (continued)

TABLE 1 SURVEY RESULTS OF LEAD-FREE GASOLINE MONITORING AND NOZZLE SWITCHING

YEAR	TOTAL GASOLINE SAMPLES	CONTAMINA-TIONS	RATE OF CONTAMINATIONS	TOTAL SURVEYED NOZZLES	UNDER SIZED NOZZLES	NOZZLE SWITCH RATE
1974	317	7	2.2%			
1975	207	3	1.5%			
1976	284	12	4.2%			
1977	637	11	1.7%			
1978	93	6	6.5%			
1979	155	15	9.7%			
1980	251	5	2.0%	522	0	0%
1981	311	9	3.0%	434	43	10%
1982	-	-	-	-	-	-
1983	331	6	1.8%	626	457	73%
1984	398	10	2.5%	887	123	14%
1985	567	15	2.6%	1215	114	9%
1986	358	5	1.4%	781	49	6%
1987	268	2	0.8%	620	20	3.2%
1988	501	3	0.6%	893	39	4.4%
1989	303	0	0.0%	502	7	1.4%

1 INTRODUCTION

Lead is a toxic element to human health. Fortunately, advances in industrial hygiene have virtually eliminated acute lead poisoning. But chronic exposure to low levels of lead are known to interfere with haemoglobin synthesis and are suspected of causing neurophysiological and behavioural effects, teratogenic effects, growth inhibition and hypertension. Children are thought to be particularly susceptible to the adverse effect of lead.

In 1973, Canada emissions of lead from gasoline peaked at 14,360 tonnes accounting for approximately 70 per cent of total Canadian lead emissions to the atmosphere. In 1985, the total lead emissions was reduced to 6000 tonnes, but still account for 61 per cent of total lead emissions in Canada. Effective January 1, 1987, the maximum allowable lead content in leaded gasoline was reduced from 0.77 grams per litre to 0.29 grams per litre. The Minister of Environment has announced the goal to effectively phase out lead in gasoline by 1993. In September, 1988, the Minister announced that the Federal Government will advance the deadline by slightly more than two years, to December 1, 1990.

In order to reduce exhaust emissions, car manufacturers have used a device called a "catalytic converter" in many post 1975 automobiles. This device cleans the exhaust gas before emitting it to the atmosphere and is capable of reducing carbon monoxide and hydrocarbon emissions by 80% to 90%. The cleaning action of the catalyst converts the harmful carbon monoxide and hydrocarbons into relatively harmless water vapour and less harmful carbon dioxide gas. Recently, a new 3-way catalyst can, at the same time, reduce the emission of carbon monoxide and hydrocarbons as well as oxides of nitrogen. The 3-way catalyst is required to meet the new or more stringent car exhaust emission standards that became effective in September, 1987 for 1988 model year production vehicles.

Catalytic converters cannot tolerate contaminants such as lead in gasoline. When burned in the combustion chamber of an engine, the lead in gasoline becomes fine particles of metallic lead or its compounds. These fine particles form a coating over the catalyst and reduces its cleaning action by "poisoning" the catalyst. Several tank refills with leaded gasoline can poison the catalyst extensively and render the converter useless.

Federal Regulations were promulgated in 1974 to limit the maximum lead concentration to 0.013 grams per litre in lead-free gasoline to ensure that the platinum catalyst is protected from damage. Some provincial governments including Ontario, Nova Scotia and Quebec have passed regulations to prohibit nozzle switching at gasoline retail outlets. In April 1987, British Columbia added a 2¢ per litre sales tax to leaded gasoline, which resulted with price equalization for leaded and lead-free gasoline and has removed what appears to have been a major incentive of some motorists to misfuel their cars. At the same time, the petroleum refining industry designed and implemented strict procedures for gasoline handling to ensure that the lead-free gasoline products are not contaminated by lead.

The car manufacturing industry together with the petroleum industry sought to avoid misfueling of cars by introducing a special fuel inlet restrictor inside the fuel filling pipe on cars that are only compatible with a small diameter nozzle on lead-free gas dispensing pumps. A car requiring lead-free gasoline has an inlet restrictor that can only receive gasoline from a nozzle size of 20.6 mm (13/16 inch) outside diameter. All pump nozzles for dispensing leaded gasoline are larger and have an outside diameter of 23.8 mm (15/16 inch) which prevents its use in any lead-free gas tank receptor.

If a small size nozzle (13/16" O.D.) is installed on a leaded gasoline pump, the retailer is providing an opportunity for dispensing leaded gasoline to a lead-free burning car, either intentionally or unintentionally. Some vehicle owners remove the inlet restrictor so that

the vehicle can be deliberately misfueled. Both of these practices circumvent the intent of the emission control technology on cars and should be discouraged or prohibited.

The Pacific and Yukon Regional office of Environment Canada has been conducting surveys on the lead content in gasoline and nozzle switching practices for a number of years. In each of the past three years, an additional survey was conducted to investigate the misfueling practices by motorists. This report presents the 1989 results from all these surveys.

2 LEADED GASOLINE AND LEAD-FREE GASOLINE MONITORING

Samples of leaded gasoline were obtained from retail outlets in the Greater Vancoauver area and analyzed for lead concentration by the atomic absorption method.

The lead-free gasoline survey was also based on a spot check of retail outlets. It was conducted in several geographical areas in B.C., typically the Greater Vancouver, Vancouver Island and Okanagan areas. Gasoline retail outlets in urban centres were visited without predetermination of time, location or brand. A surveyed area would not be revisited in the same year unless a serious contamination problem had been identified.

The samples of lead-free gasoline that were collected at retail outlets were analyzed the following day using a quick test colorimetric analyzer. When a high lead concentration was detected by the quick test, the sample was then analyzed again using the atomic absorption method to confirm the quick test result.

3 NOZZLE SWITCHING SURVEY

The nozzle switching survey was conducted in conjunction with the gasoline sampling program. The size of nozzles on leaded gasoline pumps was checked with a plastic template (Figure 1).

FIGURE 1 Plastic Template for Nozzle Size Measurement

The template can be used to quickly check nozzle size and identify undersized nozzles. Table 2 shows nozzle sizes that have been encountered.

TABLE 2 NOZZLE SIZE OF GASOLINE DISPENSING PUMPS

NOZZLE SIZE	OUTSIDE DIAMETER		INDICATION ON TEMPLATE	IMPLICATION
	mm	Inch		
Large	23.8	15/16	Does not fit into opening	Correct size to dispense leaded gasoline
Small	20.6	13/16	Fits into inner opening	One can dispense leaded gasoline easily to cars requiring unleaded gasoline
Medium	22.2	14/16	Fits into outer opening	One can dispense leaded gas to cars requiring lead-free gas by forcing the nozzle into the receptor neck

4 MISFUELING SURVEY

A separate survey was conducted in Vancouver to assess the practice of misfueling cars. In this survey, a technician observed vehicle refueling and interviewed motorists at 7 retail outlets, spending part of a day at each outlet. Information was recorded on the total number of vehicles refueled, type of fuel required for each vehicle, the presence or absence of the fuel inlet restrictor in the fill pipe, and the reason for using leaded or unleaded gas. A copy of the survey data sheet is included in Appendix I.

5 RESULTS

5.1 Leaded Gasoline Monitoring

A total of 29 leaded gasoline samples were collected, all in the Greater Vancouver area. Five of those samples were found to exceed slightly the allowable lead content of 0.290 grams per litre. This yields a non-compliance rate of 17.2%. Three of the samples were taken from Shell outlets, one from a Turbo and one from an Independent outlet. Further details of the results are tabulated in Table 3 and Table 4.

TABLE 3 LEADED GASOLINE MONITORING - AREAS SAMPLED

AREA SAMPLED	DATE(S) SAMPLED	NO. OF STATIONS	NO. OF SAMPLES	NON-COMPLIANCE #	NON-COMPLIANCE %
ABBOTSFORD	JULY 24	6	6	0	0.0
CLEARBROOK	JULY 24	5	5	3	60.0
VANCOUVER	AUG 9	8	8	1	12.5
BURNABY	AUG 23	10	10	1	10.0
TOTAL		29	29	5	17.2

TABLE 4 LEADED GASOLINE MONITORING - NON-COMPLIANCES

SAMPLE NUMBER	DATE(S) SAMPLED	A.A. TEST [PB] g/l	BRAND	GRADE	LOCATION
072-4	24-07-89	0.295	IND.	REG.	CLEARBROOK
078-6	24-07-89	0.325	TURBO	REG.	CLEARBROOK
081-7	24-07-89	0.330	SHELL	REG.	CLEARBROOK
213-19	09-08-89	0.319	SHELL	REG.	VANCOUVER
307-21	23-08-89	0.303	SHELL	REG.	BURNABY

5.2 Lead-Free Gasoline Monitoring

A total of 303 lead-free gasoline samples from 14 brands were collected from retail outlets in 30 municipalities in the Lower Mainland, the Fraser Valley, the Okanagan area and Vancouver Island. None of these samples were found containing in excess of the allowable lead content of 0.013 grams per litre. Further details of the results are tabulated in Tables 5 and 6.

5.3 Nozzle Survey

A total of 502 nozzles on leaded gas pumps were measured and 7 were undersized. This yields a nozzle switching rate of 1.4% as a B.C. average; 0.9% in the Lower Mainland, 1.4% in Victoria and 2.2% in the Okanagan area. Nozzle switching practices have generally decreased since 1985 when the switching rates were 9.4% as the B.C. average; 4.3% in Vancouver, and 18.0% in the Okanagan area. The detailed results of the 1989 survey are presented in Tables 7 and 8.

AREA	TOTAL NOZZLES SURVEYED	NUMBER OF UNDERSIZED NOZZLES	PERCENTAGE OF UNDERSIZED NOZZLES
Greater Vancouver	216	2	0.9%
Okanagan	138	3	2.2%
Vancouver Island	148	2	1.4%
Total	502	7	1.4%

5.4 Misfueling Survey

The survey was conducted at 7 gas stations of different brands in the Vancouver area. The locations were selected to provide a reasonable geographic distribution. Approval from the respective retail outlet was obtained prior to the survey. All 7 stations offered both leaded and unleaded gas.

A total of 250 vehicle refuelings were surveyed, of which 172 were lead-free refuelings and 78 were leaded refuelings. Among the 78 cars that were designed to run on leaded fuel, 11 were refueled with unleaded gasoline. Among the 172 cars that were designed to use unleaded fuel, not a single one was refueled with leaded gasoline. However, 10 vehicles showed evidence of tampering with the fuel inlet restrictors, either by widening the restrictor or by removing it completely. In April 1987, the provincial government added a 2¢ per litre sales tax to leaded gasoline which resulted in a price equalization between the regular grades of leaded and lead-free gasoline.

The survey also found that among the 172 vehicles that required lead-free gasoline, there were 9 vehicles with no unleaded label and 7 vehicles with no catalytic converter present.

Among the 250 motorists who were intervieved, it was found that the car size distribution was as follows:

Class	No. of Vehicles	Percent
4 cylinders	132	52.8%
6 cylinders	79	31.6%
8 cylinders	39	15.6%

Amoung the 250 vehicles that were surveyed, it was found that the car age distribution was as follows:

Model Year	No. of Vehicles	Percent
1961-1974	33	13.4%
1975-1980	74	29.7%
1981-1985	78	31.1%
1986-1989	65	25.8%

6 DISCUSSION

This is the first time in 15 years that we found full compliance with the Lead-Free Gasoline Regulations. Out of a total 303 samples, none contained lead in excess of 0.013 g/L, which is a further improvement as compared to 0.6% in 1988, 0.8% in 1987, 1.4% in 1986 and 2.6% in 1985. This reflects a positive and notable achievement in the gasoline marketing system and reflects improved quality control efforts by the petroleum industry.

Since January 1987 when the amended Leaded Gasoline Regulations became effective, there were no violations reported by the leaded gasoline production plants in B.C. However, 5 of the 29 leaded samples collected at retail outlets had lead concentrations slightly above 0.29 grams/litre. The rate of leaded gasoline non-compliance is therefore 17.2%.

The nozzle switching practice as a provincial average, decreased to 1.4% as compared to 4.4% in 1988, and remained improved from 3.2% in 1987, 6.3% in 1986 and 9% in 1985. In the Greater Vancouver area, the rate was 0.9% in 1989 as compared to 3.9% in 1988, 3.2% in 1987, 2.3% in 1986 and 4.3% in 1985. The nozzle switching rate on Vancouver Island was 1.4% in 1989, which was an improvement from 7.3% in 1988, 14.7% in 1986 and 8.6% in 1985. In the Okanagan, the switching rate was 2.2% in 1989.

The vehicle misfueling survey in 1989 found no misfuelers among the 250 surveyed motorists. The public avareness efforts of the federal and provincial governments and industry continue to have had a positive effect on the public. In April 1987, the prices for regular grades of leaded and lead-free gasoline were equalized when the British Columbia government added a 2¢ per litre sales tax to leaded gasoline. This price equalization removed what appeared to have been a major incentive for some motorists to misfuel their cars.

As a result of public awareness and government action to reduce lead in gasoline, the demand and supply of lead-free gasoline has increased steadily in B.C., from a mere 5.2% of total gas production in 1975, to 58.6% in 1988, as indicated in Figure 2. Also, the increased use of lead-free gasoline by the general public has resulted with improvement in air quality. By using lead measurement data from 5 air monitoring stations in Vancouver, which have been operating since 1975, the lead in ambient air has been reduced to 20% of the 1975 level, from a 0.8 ug/m (micrograms per cubic meters) in 1975 to the 1988 level of 0.16 ug/m^3 as indicated in Figure 3.

Figure 2 **LEAD IN GASOLINE**

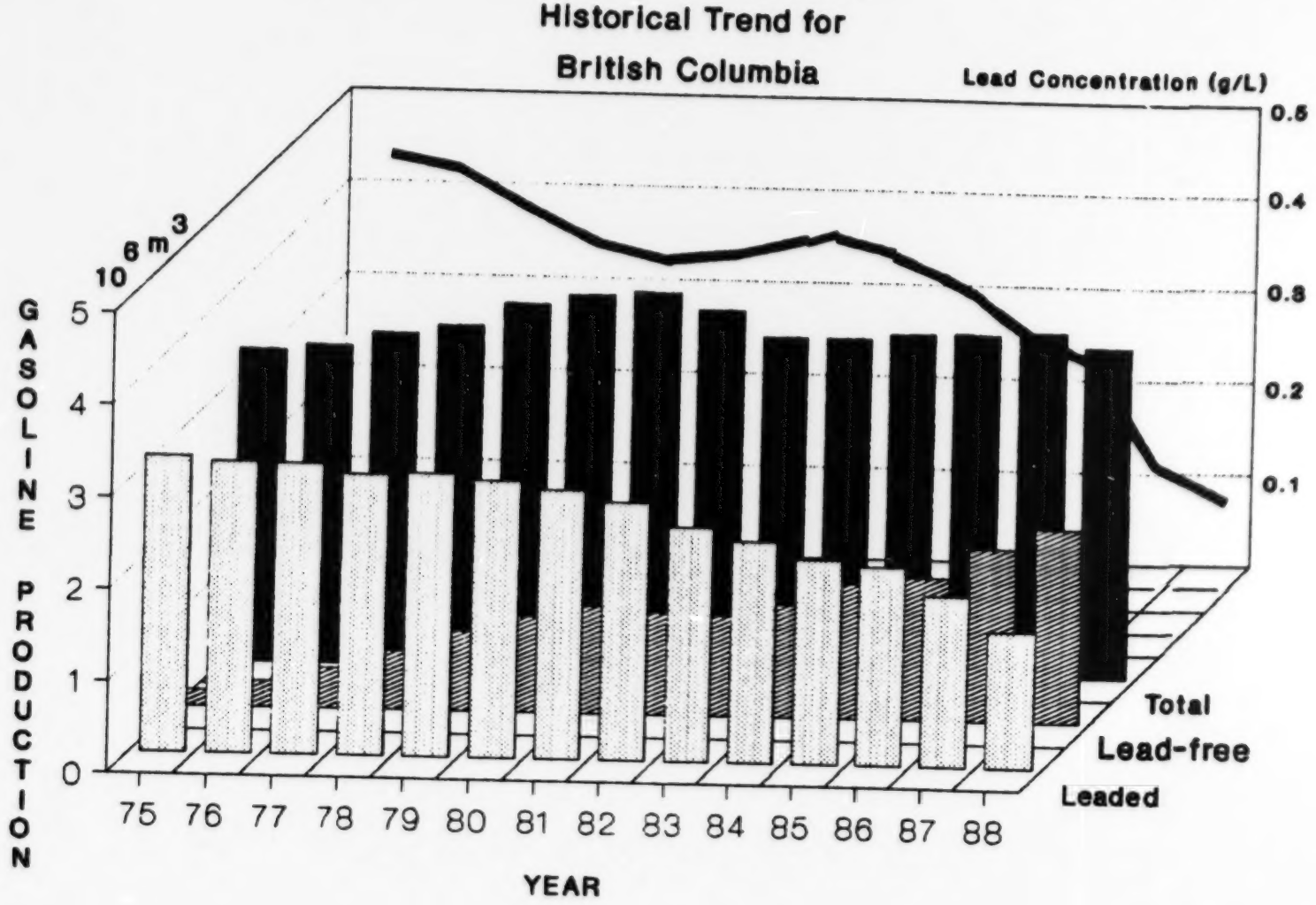


FIG 3 Ambient Lead Concentration in Vancouver

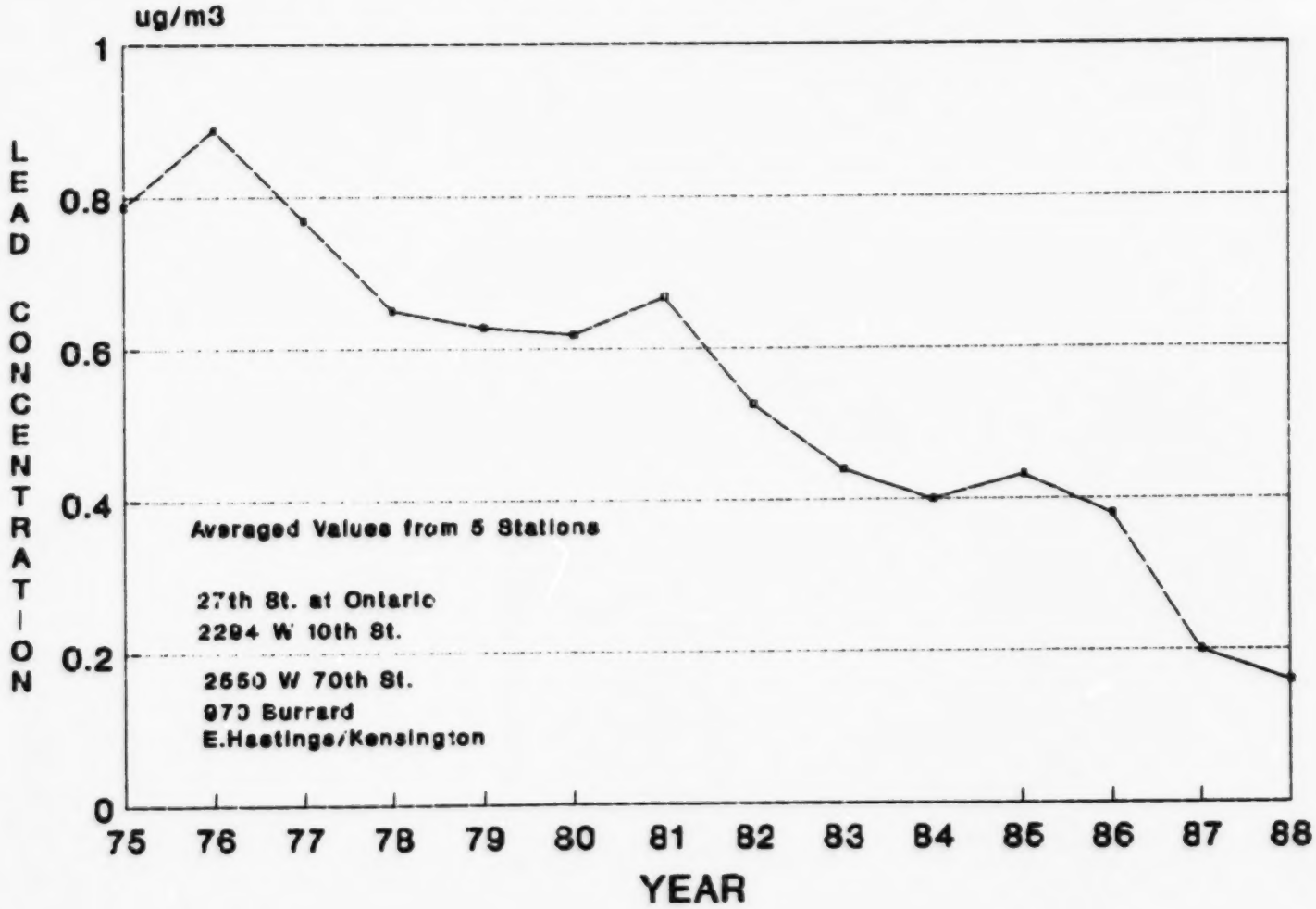


TABLE 5 LEAD-FREE GASOLINE MONITORING - BRITISH COLUMBIA

BRAND	# OF STATIONS	# OF SAMPLES	NON-COMPLIANCES	
			#	%
ESSO	28	50	0	0.0
CHEVRON	28	53	0	0.0
SHELL	25	43	0	0.0
PETRO-CAN	28	56	0	0.0
TEXACO	17	34	0	0.0
PAYLESS	8	15	0	0.0
HUSKY	4	8	0	0.0
TURBO	4	8	0	0.0
SUPER SAVE	5	6	0	0.0
MOHAWK	6	10	0	0.0
DOMO	1	2	0	0.0
IND.	6	13	0	0.0
SAVE ON GAS	1	2	0	0.0
PAY & SAVE	2	3	0	0.0
TOTAL	162	303	0	0.0

TABLE 6 LEAD-FREE GASOLINE MONITORING - AREAS SAMPLED

AREA SAMPLED	DATE(S) SAMPLED	# OF STATIONS	# OF SAMPLES	NON-COMPLIANCES	
				#	%
Lower Mainland					
North Vancouver	July 14,19,21	23	44	0	0
West Vancouver	July 20	8	15	0	0
Abbotsford	July 24	6	11	0	0
Clearbrook	July 24	5	10	0	0
Vancouver	Aug 9	8	16	0	0
New Westminster	Aug 4	8	15	0	0
Burnaby	Aug 23	11	21	0	0
Subtotal		70	134	0	0
Vancouver Island					
Sidney	July 26	6	8	0	0
Victoria	July 26,27	18	34	0	0
Mill Bay	July 27	2	3	0	0
Covichan Bay	July 27	1	1	0	0
Duncan	July 27	5	10	0	0
Ladysmith	July 27	3	6	0	0
Nanaimo	July 27	10	19	0	0
Subtotal		45	81	0	0

TABLE 6 LEAD-FREE GASOLINE MONITORING - AREAS SAMPLED (Continued)

AREA SAMPLED	DATE(S) SAMPLED	# OF STATIONS	# OF SAMPLES	NON-COMPLIANCES	
				#	%
OKANAGAN					
Princeton	Aug 14	5	10	0	0
Hedley	14	1	1	0	0
Keremeos	14	3	4	0	0
Kalenden	14	1	2	0	0
Trout Creek	15	1	2	0	0
Summerland	15	2	3	0	0
Peachland	15	1	2	0	0
Westbank	15	3	6	0	0
Kelowna	15	5	10	0	0
Vernon	15	5	10	0	0
Armstrong	15	1	2	0	0
Penticton	16	5	10	0	0
Falkland	17	1	2	0	0
Kamloops	17	6	12	0	0
Hope	18	4	6	0	0
Chilliwack	18	3	6	0	0
SUBTOTAL		47	88	0	0

TABLE 7 NOZZLE SURVEY - BRITISH COLUMBIA

Total Number of Stations Surveyed : 162
Total Number of Leaded Nozzles Measured : 502
Total Number of Undersized Nozzles : 7 (1.4%)

BRAND	NO. OF STATIONS	NO. OF UNDER-SIZED NOZZLES	% OF STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NUMBER UNDERSIZED	PERCENT UNDERSIZED
ESSO	28	1	3.6	71	1	1.4
CHEVRON	28	1	3.6	126	1	0.8
SHELL	25	0	0.0	68	0	0.0
PETRO-CAN	28	1	3.6	85	1	1.2
TEXACO	17	0	0.0	48	0	0.0
PAYLESS	8	1	12.5	37	1	2.7
HUSKY	4	1	25.0	9	1	11.0
TURBO	4	0	0.0	8	0	0.0
SUPER SAVE	6	1	16.7	12	1	8.3
MOHAWK	6	0	0.0	14	0	0.0
DOMO	1	0	0.0	2	0	0.0
IND.	5	1	16.7	17	1	5.9
SAVE ON GAS	1	0	0.0	1	0	0.0
PAY & SAVE	2	0	0.0	4	0	0.0
TOTAL	162	7	4.9	502	7	1.4

TABLE 8 NOZZLE SURVEY - LOWER MAINLAND (BY BRANDS)

Total Number of Stations Surveyed : 70
Total Number of Leaded Nozzles Measured : 216
Total Number of Undersized Nozzles : 2 (0.9%)

BRAND	NO. OF STATIONS	NO. W/UNDER-SIZED NOZZLES	% OF STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NO. OF UNDER-UNDERSIZED	PERCENT UNDERSIZED
ESSO	11	0	0.0	32	0	0.0
CHEVRON	14	0	0.0	61	0	0.0
SHELL	12	0	0.0	31	0	0.0
PETRO-CAN	13	0	0.0	39	0	0.0
TEXACO	8	0	0.0	25	0	0.0
PAYLESS	0	0	0.0	0	0	0.0
HUSKY	1	1	100.0	2	1	50.0
TURBO	1	0	0.0	2	0	0.0
SUPER SAVE	5	1	20.0	11	1	9.1
MOHAWK	3	0	0.0	7	0	0.0
DOMO	1	0	0.0	2	0	0.0
IND.	1	0	0.0	4	0	0.0
SAVE ON GAS	0	0	0.0	0	0	0.0
PAY N' SAVE	0	0	0.0	0	0	0.0
TOTAL	70	2	2.9	216	2	0.9

TABLE 9 NOZZLE SURVEY - OKANAGAN (BY BRANDS)

Total Number of Stations Surveyed : 47
Total Number of Leaded Nozzles Measured : 138
Total Number of Undersized Nozzles : 3 (2.2%)

BRAND	NO. OF STATIONS	NO. W/UNDER-SIZED NOZZLES	% OF STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NO. OF UNDER-UNDERSIZED	PERCENT UNDERSIZED
ESSO	11	1	9.1	30	1	3.3
CHEVRON	7	0	0.0	32	0	0.0
SHELL	6	0	0.0	22	0	0.0
PETRO-CAN	6	1	16.7	20	1	5.0
TEXACO	4	0	0.0	7	0	0.0
PAYLESS	0	0	0.0	0	0	0.0
HUSKY	2	1	0.0	4	0	0.0
TURBO	3	0	0.0	6	0	0.0
SUPER SAVE	1	1	0.0	1	0	0.0
MOHAWK	3	0	0.0	7	0	0.0
DOMO	0	0	0.0	0	0	0.0
IND.	2	1	50.0	5	1	20.0
SAVE ON GAS	0	0	0.0	0	0	0.0
PAY N' SAVE	2	0	0.0	4	0	0.0
TOTAL	47	3	6.4	138	3	2.2

TABLE 10 NOZZLE SURVEY - VANCOUVER ISLAND (BY BRANDS)

Total Number of Stations Surveyed : 45
Total Number of Leaded Nozzles Measured : 148
Total Number of Undersized Nozzles : 2 (1.4%)

BRAND	NO. OF STATIONS	NO. W/UNDER-SIZED NOZZLES	% OF STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NO. OF UNDER-UNDERSIZED	PERCENT UNDERSIZED
ESSO	6	0	0.0	9	0	0.0
CHEVRON	7	1	14.3	33	1	3.0
SHELL	6	0	0.0	35	0	0.0
PETRO-CAN	9	0	0.0	26	0	0.0
TEXACO	5	0	0.0	16	0	0.0
PAYLESS	8	1	12.5	37	1	2.7
HUSKY	1	0	0.0	3	0	0.0
TURBO	0	0	0.0	0	0	0.0
SUPER SAVE	0	0	0.0	0	0	0.0
MOHAWK	0	0	0.0	0	0	0.0
DOMO	0	0	0.0	0	0	0.0
IND.	2	0	0.0	8	0	0.0
SAVE ON GAS	1	0	0.0	1	0	0.0
PAY N' SAVE	0	0	0.0	0	0	0.0
TOTAL	45	2	4.4	148	2	1.4

TABLE 11 NOZZLE SURVEY - LOWER MAINLAND (BY AREA)

AREA	NO. OF STATIONS	NO. OF UNDER-SIZED NOZZLES	% STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NUMBER UNDERSIZED	PERSENT UNDERSIZED
Lower Mainland						
North Vancouver	23	0	0.0	72	0	0.0
West Vancouver	9	1	11.1	22	1	4.5
Abbotsford	6	1	16.6	17	1	5.9
Clearbrook	5	0	0.0	15	0	0.0
Vancouver	8	0	0.0	26	0	0.0
New Westminster	8	0	0.0	24	0	0.0
Burnaby	11	0	0.0	40	0	0.0
TOTAL	70	2	2.9	216	2	0.9

TABLE 12 NOZZLE SURVEY - OKANAGAN (BY AREA)

AREA	NO. OF STATIONS	NO. OF UNDER-SIZED NOZZLES	% STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NUMBER UNDERSIZED	PERSENT UNDERSIZED
OKANAGAN						
Princeton	5	0	0.0	24	0	0.0
Hedley	1	1	100.0	3	1	33.3
Keromeos	3	0	0.0	6	0	0.0
Kalenden	1	0	0.0	2	0	0.0
Trout Creek	1	0	0.0	2	0	0.0
Summerland	2	0	0.0	4	0	0.0
Peachland	11	0	0.0	1	0	0.0
Westbank	3	0	0.0	18	0	0.0
Kelowna	5	0	0.0	16	0	0.0
Vernon	5	0	0.0	10	0	0.0
Armstrong	1	1	100.0	2	1	50.0
Penticton	5	0	0.0	10	0	0.0
Falkland	1	0	0.0	2	0	0.0
Kamloops	6	1	16.6	19	1	5.3
Hope	4	0	0.0	11	0	0.0
Chilliwack	3	0	0.0	8	0	0.0
TOTAL	70	2	2.9	216	2	0.9

TABLE 13 NOZZLE SURVEY - VANCOUVER ISLAND (BY AREA)

AREA	NO. OF STATIONS	NO. OF UNDER-SIZED NOZZLES	% STATIONS W/ UNDERSIZED NOZZLES	NO. OF LEADED NOZZLES	NUMBER UNDERSIZED	PERCENT UNDERSIZED
VANCOUVER ISLAND						
Sidney	6	0	0.0	11	0	0.0
Victoria	18	1	5.6	65	1	1.5
Mill Bay	2	0	0.0	3	0	0.0
Cowichan Bay	1	0	0.0	2	0	0.0
Duncan	5	0	0.0	18	0	0.0
Ladysmith	3	1	33.3	14	1	6.3
Nanaimo	10	0	0.0	35	0	0.0
TOTAL	45	2	4.4	148	2	1.4

APPENDIX I

DATA RECORDING FORMAT
FOR THE MISFUELING SURVEY

SERVICE STATION RECORD

1. Service Station Brand Name: _____

2. Type of Service Station: Full Serve _____ Self Serve _____

   Both Full and Self Serve _____

3. Types of Gasoline Available: Leaded Only _____

   Lead-Free Only _____

   Both _____

4. Incidence of Nozzle Substitution:

   Number of Leaded Pump Nozzles _____ ID _____

   Number of Undersized Nozzles _____ ID _____

5. Total Number of Motorists using: Unleaded _____

   Leaded _____

   Total _____

6. Total Number of Motorists using Undersized Nozzles _____

7. Total Number of Unleaded Vehicles using Leaded Gas _____

8. Misfuelling Rate: _____%

SURVEY FORM NO. 2

CAR MAINTENANCE AND FUEL USE

We appreciate your cooperation in providing information on the type of fuel used in your car. This survey is being conducted by the Federal Department of Environment. The collected information will be helpful to assess the vehicle emissions contributed to air pollution in Vancouver.

1. ID NUMBER _____ PUMP NO. _____

2. MAKE _____ MODEL _____

   YEAR _____

3. SIZE CLASS: COMPACT (4 cylinders) _____

   MID-SIZE (6 cylinders) _____

   FULL-SIZE (8 cylinders) _____

4. AREA OF RESIDENCE: _____

5. FUEL DESIGNATION: UNLEADED _____ LEADED _____

6. FREQUENCY OF LEADED (UNLEADED) GASOLINE USAGE:

   Always _____ Often _____ Regularly _____

   Sometimes _____ Rarely _____ Never _____

7. UNLEADED LABEL: Yes _____ No. _____

8. FUEL INLET RESTRICTOR: Present _____ Absent _____

9. CATALYTIC CONVERTER: Present _____ Absent _____

10. How often do you tune your car? _____

11. What is the gas mileage? _____

12. "I would like to ask you why you use leaded/unleaded gasoline in your vehicle rather than unleaded/leaded? _____

_____

APPENDIX II

HISTORICAL DATA ON
LEAD-FREE GASOLINE CONTAMINATION

APPENDIX II

TABLE 1 NUMBER OF CONTAMINATED SAMPLES (1974-1989)

YEAR	NUMBER OF CONTAMINATIONS IDENTIFIED IN EPS (PACIFIC & YUKON REGION) MONITORING PROGRAM									TOTAL NO. OF SAMPLES
	C	B	D	A	E	H	F	G	OTHERS	
1974	1	1	2	2	1	0	0	0	0	317
1975	-	-	-	-	-	-	-	-	3	207
1976	0	2	1	2	3	0	0	1	3	284
1977	0	1	2	5	1	0	1	0	1	637
1978	0	0	1	3	2	0	0	0	0	93
1979	1	2	2	1	5	0	2	2	0	155
1980	1	3	2	2	0	0	1	0	0	273
1981	7	3	2	7	1	1	1	-	2	350
1982	-	-	-	-	-	-	-	-	-	---
1983	1	1	0	3	1	0	0	0	0	331
1984	0	3	2	0	0	1	1	1	2	398
1985	2	2	3	2	0	1	1	2	2	567
1986	0	0	2	0	1	0	2	0	0	358
1987	0	0	0	1	0	0	0	0	1	268
1988	0	1	0	0	2	0	0	0	0	501
1989	0	0	0	0	0	0	0	0	0	303
TOTAL	13	19	19	28	17	3	9	6	14	4739/128

A = CHEVRON

B = SHELL

C = ESSO

D = GULF

E = PETRO CAN (Formerly PACIFIC and GULF)

F = TEXACO

G = MOHAWK

H = HUSKY

APPENDIX II

TABLE 2 LIST OF CONTAMINATED LEAD-FREE GASOLINE (1974-1981)

YEAR	LEAD CONCENTRATIONS (g/IG) IN THE IDENTIFIED CONTAMINATIONS								
	C	B	D	A	E	H	F	G	OTHERS
1974	0.950	0.230	0.123 0.076	0.064 0.068	0.072	- -	- -	- -	- -
1975	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.190 0.180 0.080
1976	-	0.110 0.070	0.090	0.090 0.070	0.090 0.070 0.150	-	-	2.000	0.420 0.320 0.080
1977	-	0.127	0.180 0.230	0.090 0.080 0.190 0.080 1.000	0.123	-	-	-	-
1978	-	-	0.062	0.163 0.079 0.149	0.089 0.064	-	-	-	-
1979	0.086	0.244 0.244	0.065 0.244	0.082 0.068	0.076 0.263 0.147 0.101 0.168	-	0.063 0.147	0.282 0.263	-
* 1980	0.074 -	0.071 0.063 0.078	0.942	0.068 0.065 0.188	-	-	0.090	-	-
* 1981	0.220 0.076 0.093 0.082 0.063 0.063 0.069	0.070 0.200 0.200	0.130 0.100	0.200 0.085 0.088 0.096 0.072 0.062 0.074	0.065	0.150	0.150		0.200 0.104

* Data of Whitehorse Branch included

APPENDIX II

TABLE 3 LIST OF CONTAMINATED LEAD-FREE GASOLINE (1982-1989)

YEAR	LEAD CONCENTRATIONS (g/IG) IN THE IDENTIFIED CONTAMINATIONS								
	C	B	D	A	E	H	F	G	OTHERS
1982	-	-	-	-	-	-	-	-	-
1983	0.0172	0.0172	0	0.066 0.0273 0.048	0.026	0	0	0	0
1984	0	0.044 0.030 0.016	0.030 0.017	0	0	0.017	0.037	0.037	0.040 0.021
1985	0.018 0.030	0.040 0.028	0.015 0.015 0.031	0.028 0.021	0	0.042	0.023	0.018 0.030	0.014 0.015
1986	0	0	0.077 0.020	0	0.016	0	0.100 0.023	0	0
1987	0	0	0	0.021	0	0	0	0	0.014
1988	0	0.025	0	0	0.019 0.018	0	0	0	0
1989	0	0	0	0	0	0	0	0	0